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UNITED STATES GOVERNMENT  
MEMORANDUM

To: William F. Caton  
Acting Secretary

From: David H. Krech **DHK**  
Wireless Telecommunications Bureau

Date: June 18, 1996

Subject: Record in WT Docket 96-6 -- Amendment of the Commission's Rules to Permit Flexible Service Offerings in the Commercial Mobile Radio Services

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JUN 19 1996  
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OFFICE OF SECRETARY

Please place the two attached documents in the public record for WT Docket 96-6 -- Amendment of the Commission's Rules to Permit Flexible Service Offerings in the Commercial Mobile Radio Services. The first document is the handout distributed by Michael B. Hayes, Director of Wireless Marketing, Northern Telecom, at a presentation to the Wireless Bureau on Fixed Wireless Access on May 14, 1996. The second document is the remarks of Commissioner Susan Ness at the FCBA/Warren Publishing Wireless Communications Summit on June 10, 1996 -- "Spectrum Management Principles for the Twenty-First Century."

Attachments

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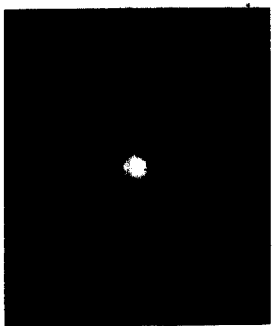
FEDERAL COMMUNICATIONS COMMISSION  
OFFICE OF SECRETARY

WIRELESS NETWORKING

PRESENTATION TO THE  
FCC WIRELESS BUREAU  
ON WIRELESS ACCESS

WIRELESS

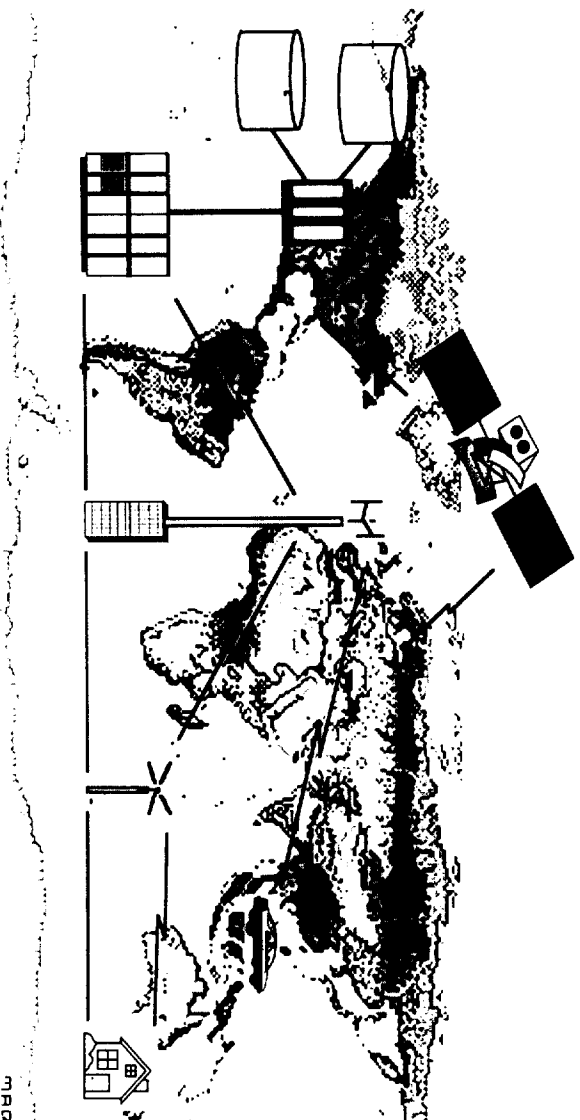
PRESENTER: MICHAEL A. ...  
DIRECTOR OF WIRELESS ...



# Tutorial

on

# Fixed Wireless Access



MRA

**What is Fixed Wireless Access (FWA)?**

**How does it work?**

**Why is it important?**

# **What is Fixed Wireless Access?**

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- ◀ **Wireless Access is the ability to provide telecommunication services such as**
  - Voice**
  - Fax**
  - & Data**
- ◀ **via Radio Waves**
  - from a radio site**
  - directly to your customer's**
  - home or business.**

# What is the scope?

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**Fixed Wireless Access is the wireless alternative to the copper or fiber subscriber local loop.**

**This access technology starts from the subscribers home terminal and extends to the appearance on the Central Office switch.**

# What is Wireless Access?

## Fixed Wireless Access Radio Access to the Subscriber

### C.O. or Controller

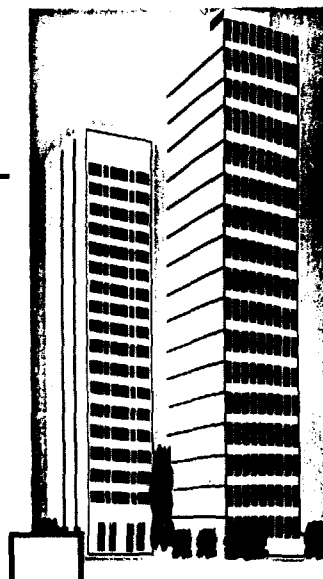
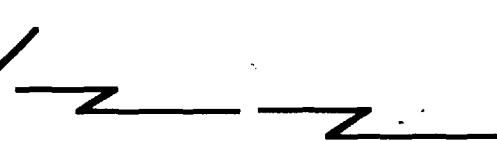


Access  
Network

Base  
Station



Radio DLC



## Traditional Access Copper or Fiber

### C.O.



MDF

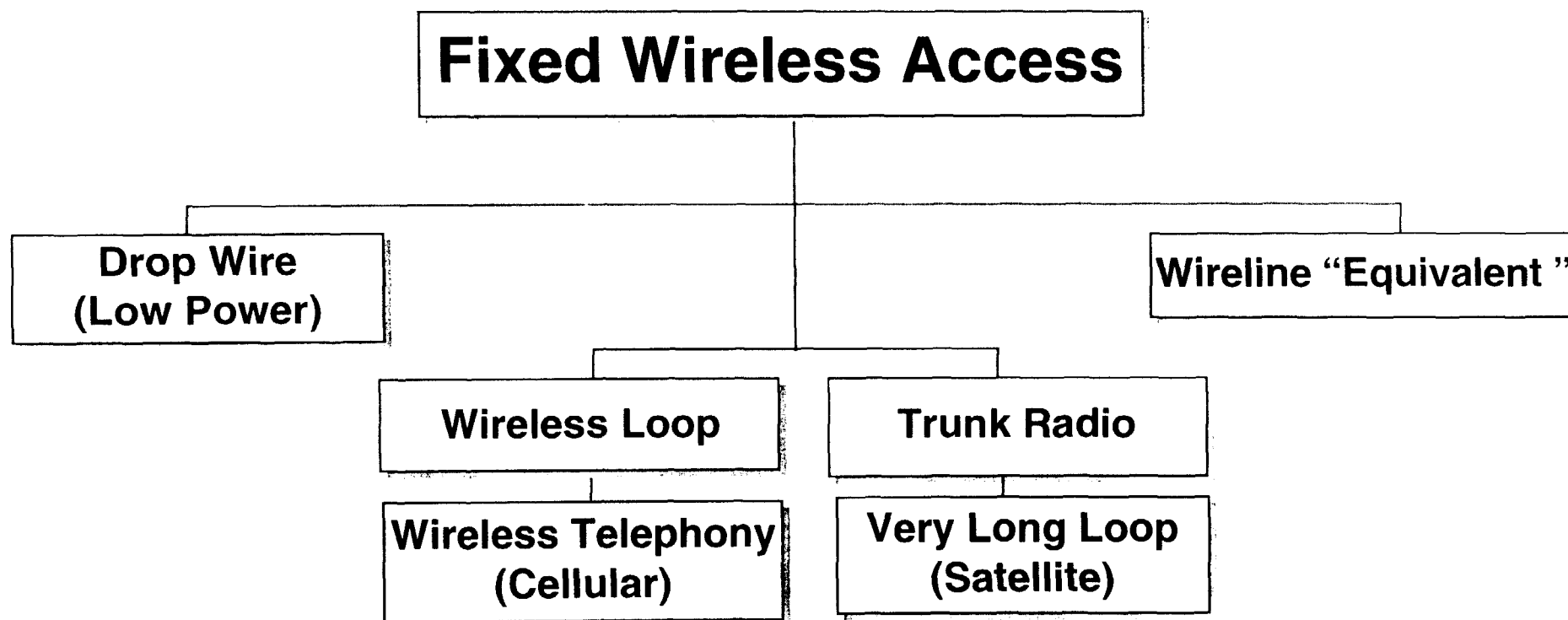
Primary  
Feeder

Secondary  
Feeder

Drop Wire

Distribution  
Point

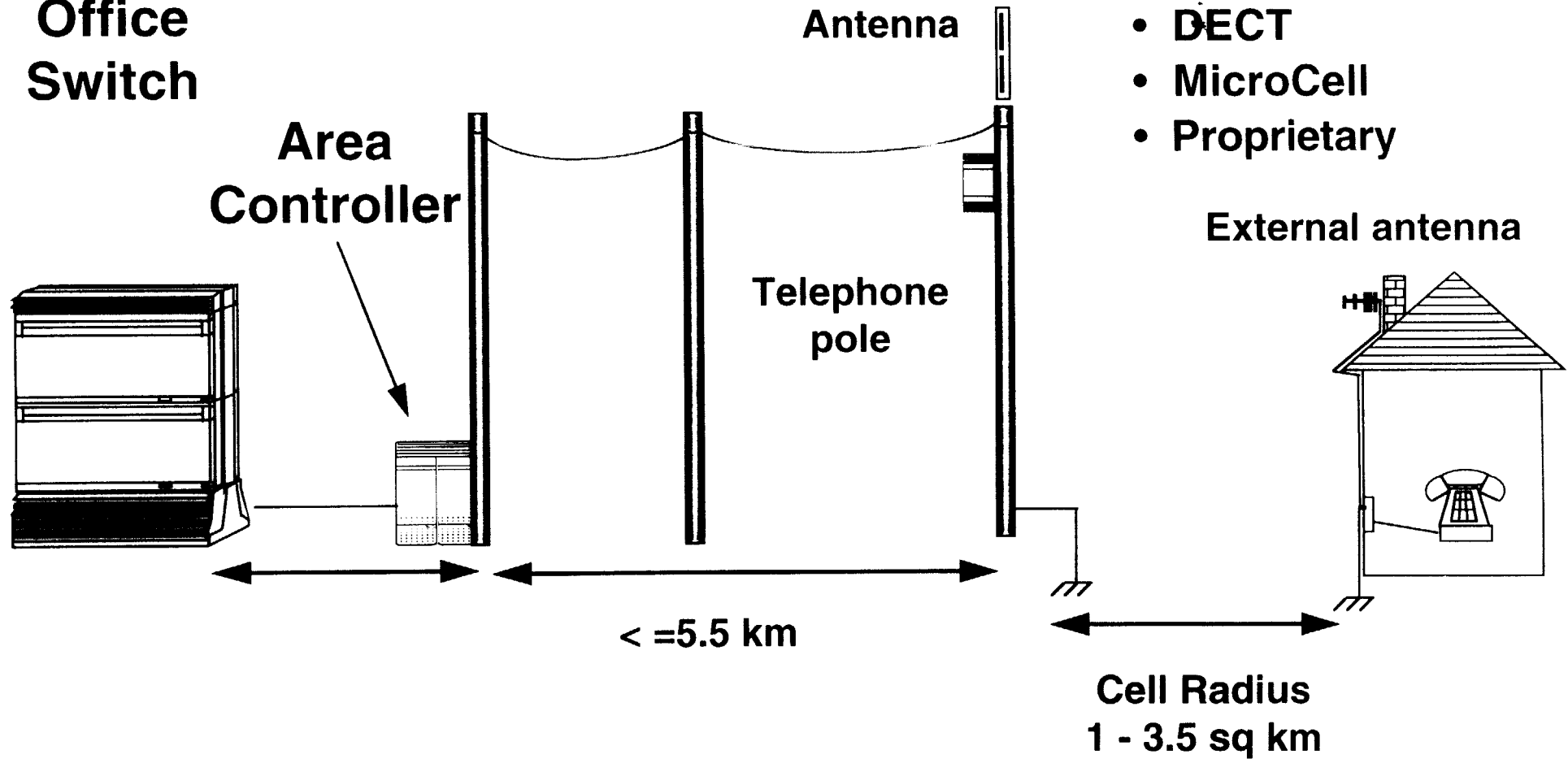
# What are some of the models of Fixed Wireless Access





# Drop Wire - Low Power

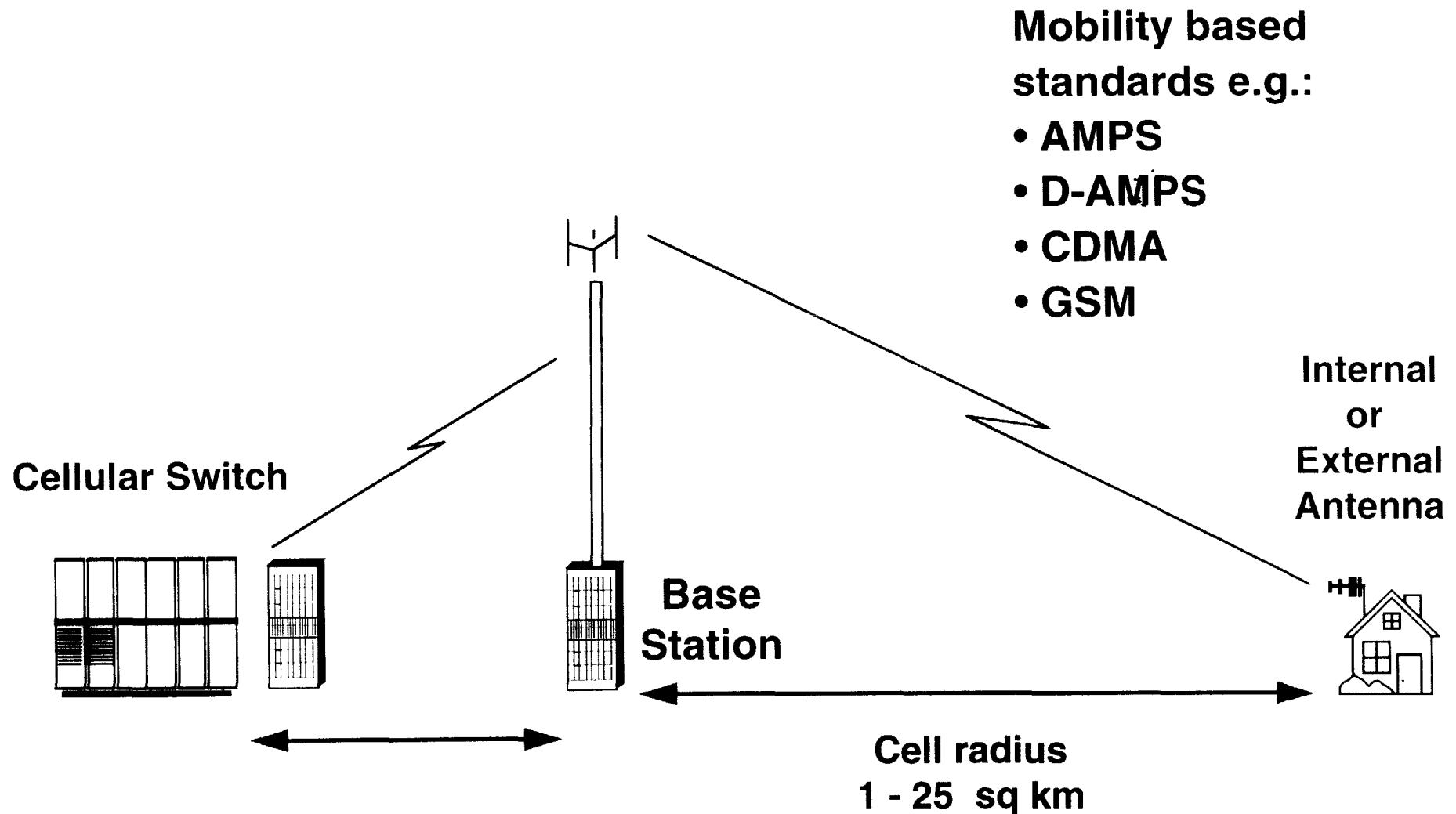
**Central  
Office  
Switch**



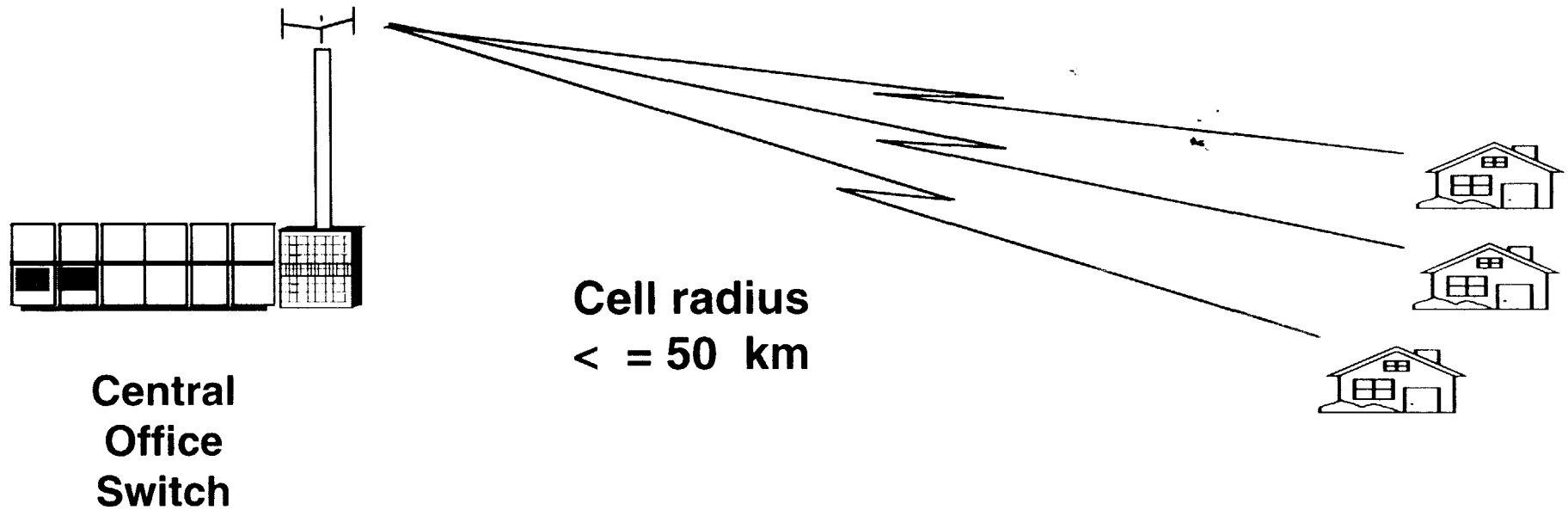
**Low power  
standards e.g.:**

- CT2
- CT2Plus
- DECT
- MicroCell
- Proprietary

# Wireless Telephony - Cellular based



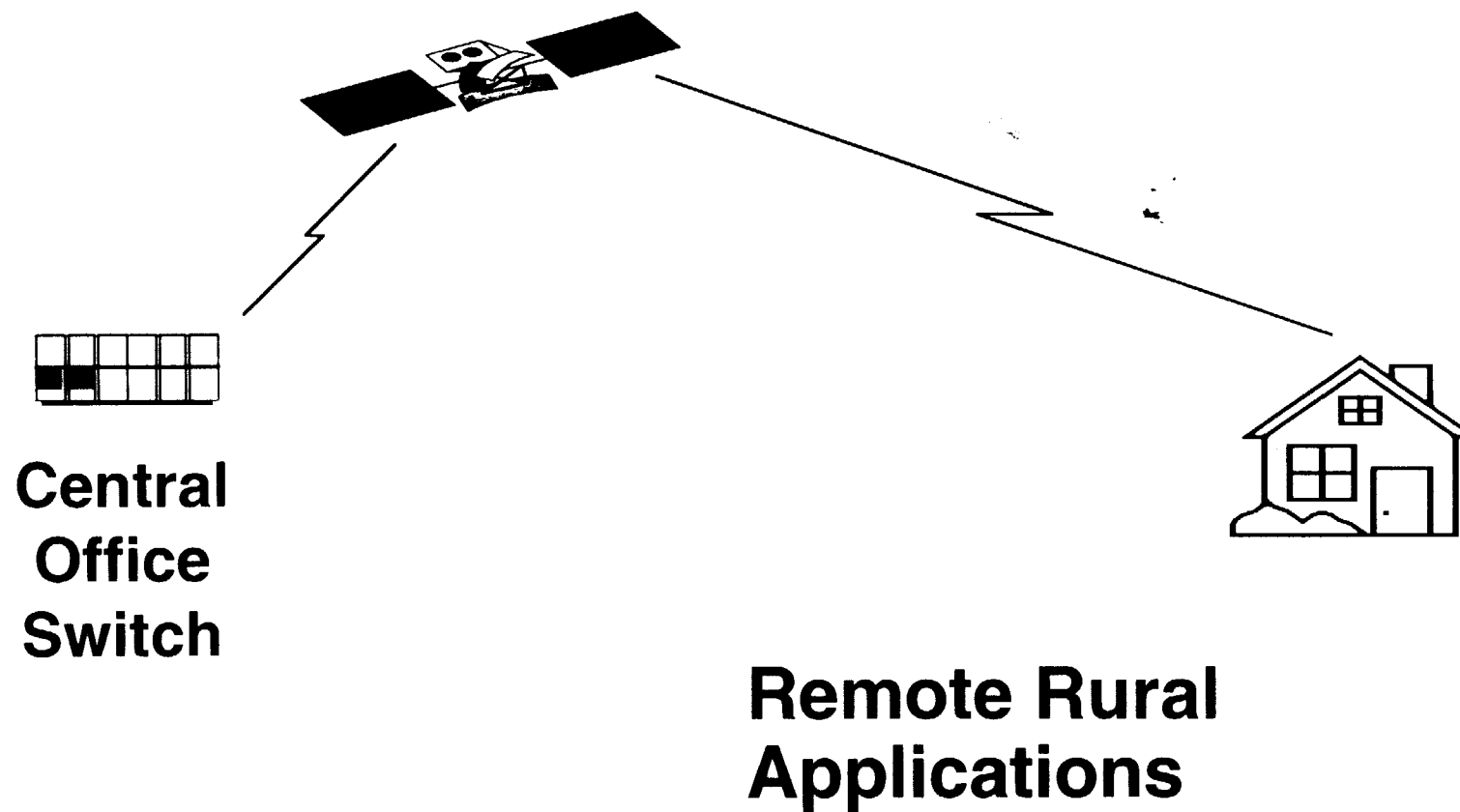
## Proprietary Systems



## Rural Applications

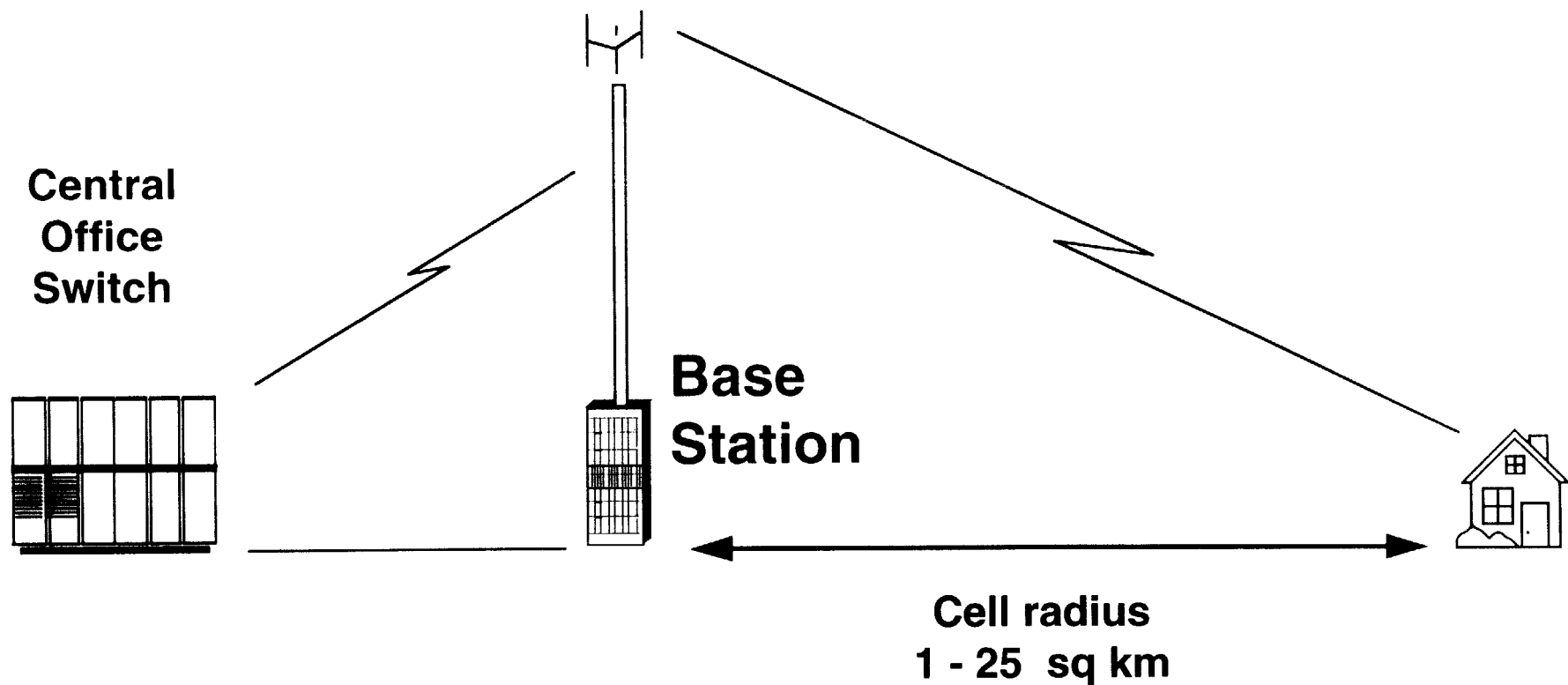
- Point to Point
- Point to Multi-Point

# Very Long Loops - Satellite



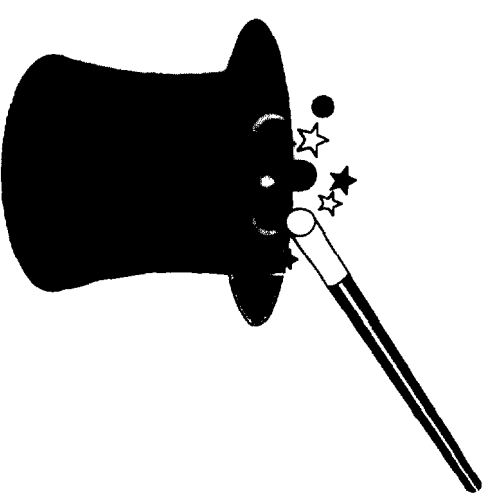
# Wireline "Equivalent" System

- Purpose Built

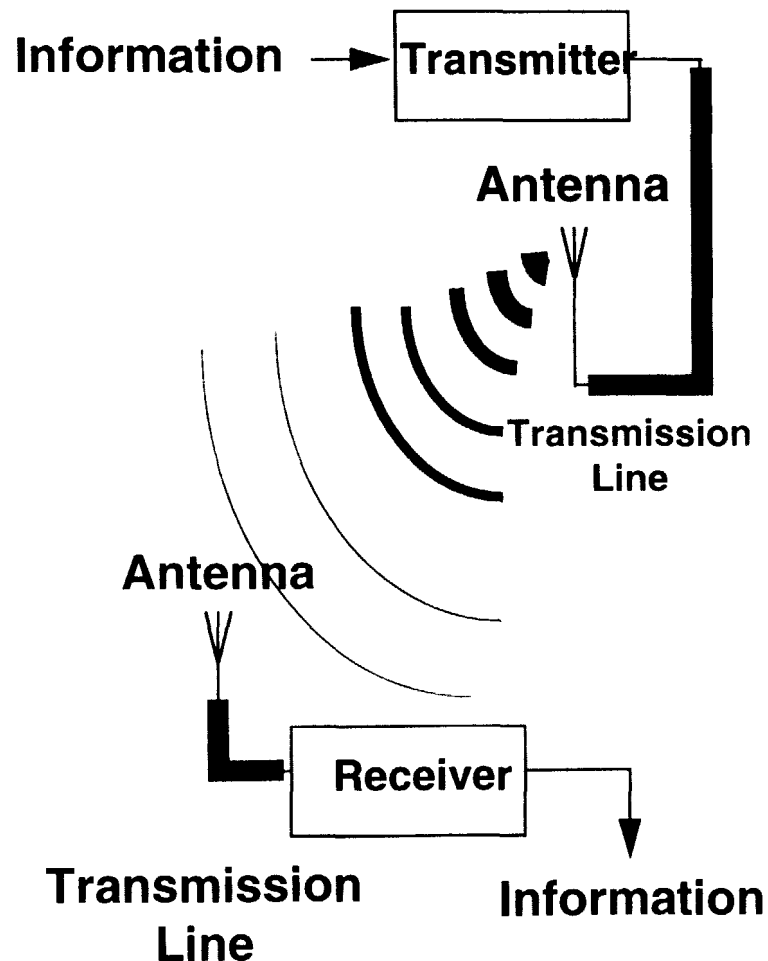


# How does it work?

## Radio Fundamentals

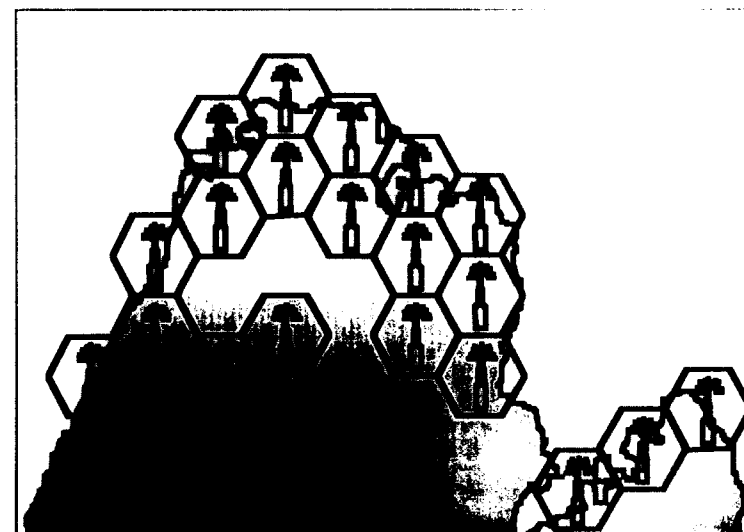
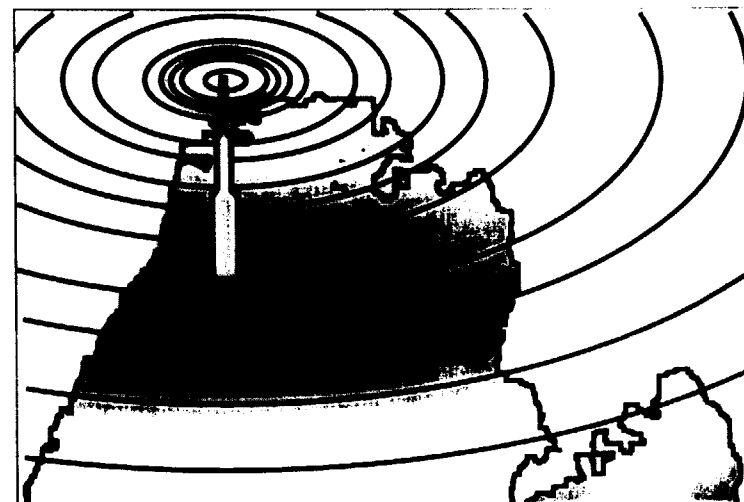


# Elements of a Radio Link



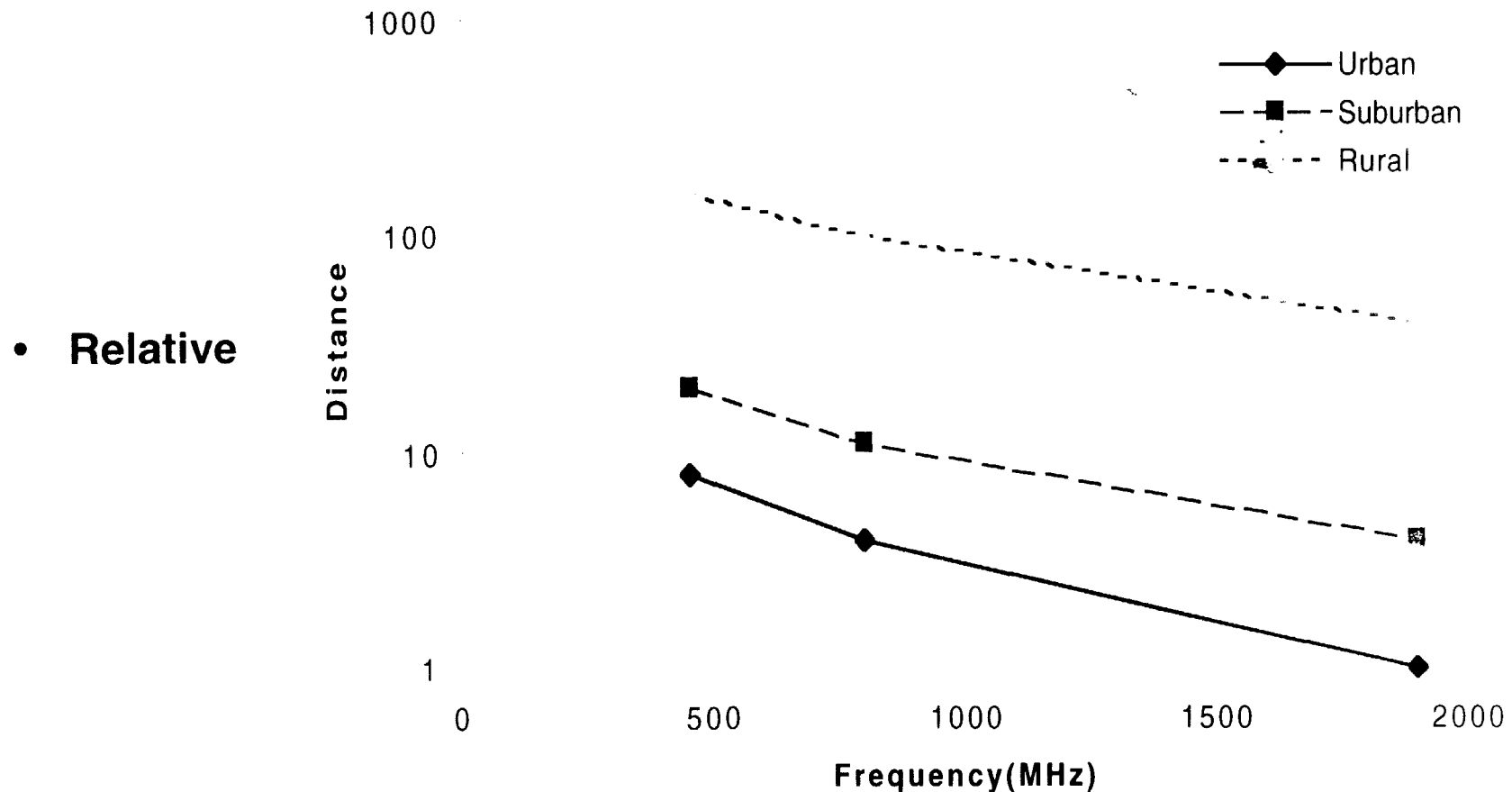
- **Transmitter**
  - Generates RF energy on a desired frequency
  - Modulates the RF energy to convey information
  -
- **Antennas**
  - Convert RF energy into electromagnetic fields, vice versa
  - Focus the energy into desired directions ("gain")
  -
- **Receiver**
  - filters out and ignores signals on undesired frequencies
  - Amplifies the tiny signal sufficiently to allow processing
  - De-modulates the signal to recover the information

- Original broadcast systems used a single high-power transmitter
- Late in the 1970's a major cellular breakthrough was to use small "cells" each with their own set of frequencies
  - ★ the same frequencies are used in several cells
  - ★ system performance becomes limited by self-interference rather than noise



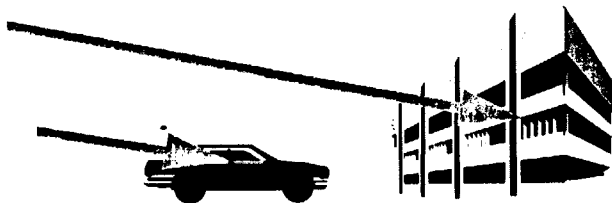
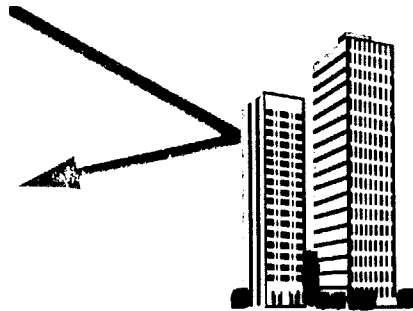
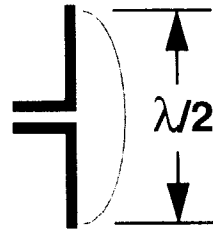


## Typical Path Loss



- Path loss outside building depends on frequency, terrain, & build-up area
- Higher frequency normally has higher loss.

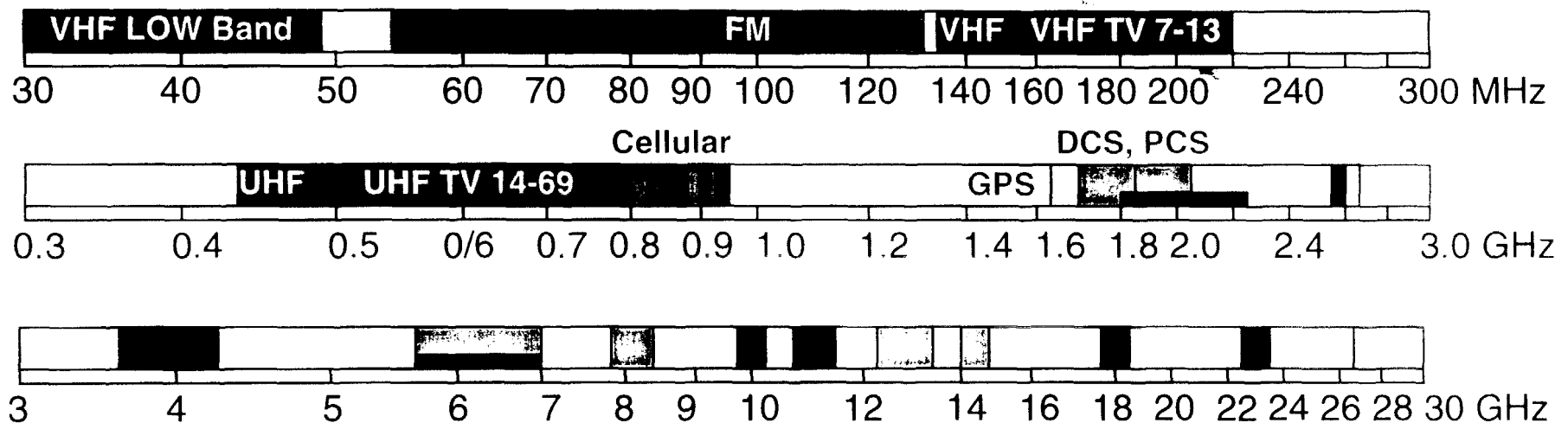
## Frequency and Wavelength



Wavelength is an important variable in RF propagation.

- Wavelength determines the approximate required size of antenna elements.
- Objects  $>10\%$  of a wavelength can reflect or block RF energy.  
Note that leaves on deciduous trees can cause major propagation differences between summer & winter
- RF can penetrate into an enclosure if it has holes roughly a wavelength in size, or larger, which can dissipate energy or increase interference.

# Radio Spectrum



**VHF (30 - 300 MHz), UHF (0.3 - 3 GHz) and SHF (3 - 30 GHz) Bands Are the Targeted Frequency Bands for Fixed Wireless Access**

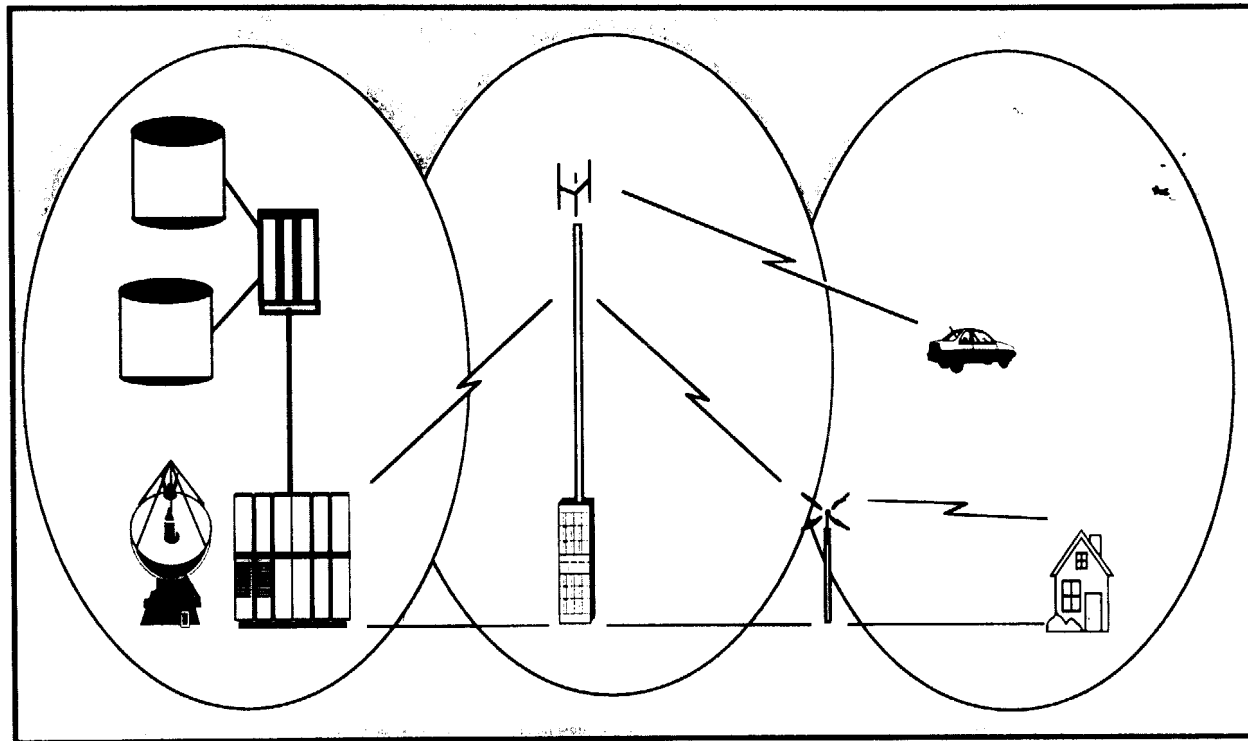
Broadcasting    Land-Mobile    Aeronautical    Mobile Telephony  
Terrestrial Microwave    Satellite

# Technology Approach

# Factors in Wireless System Selection

## System Requirements

## Service Attributes



## Radio Requirements

- Capacity
- Bandwidth
- Air Interface
- Spectrum availability

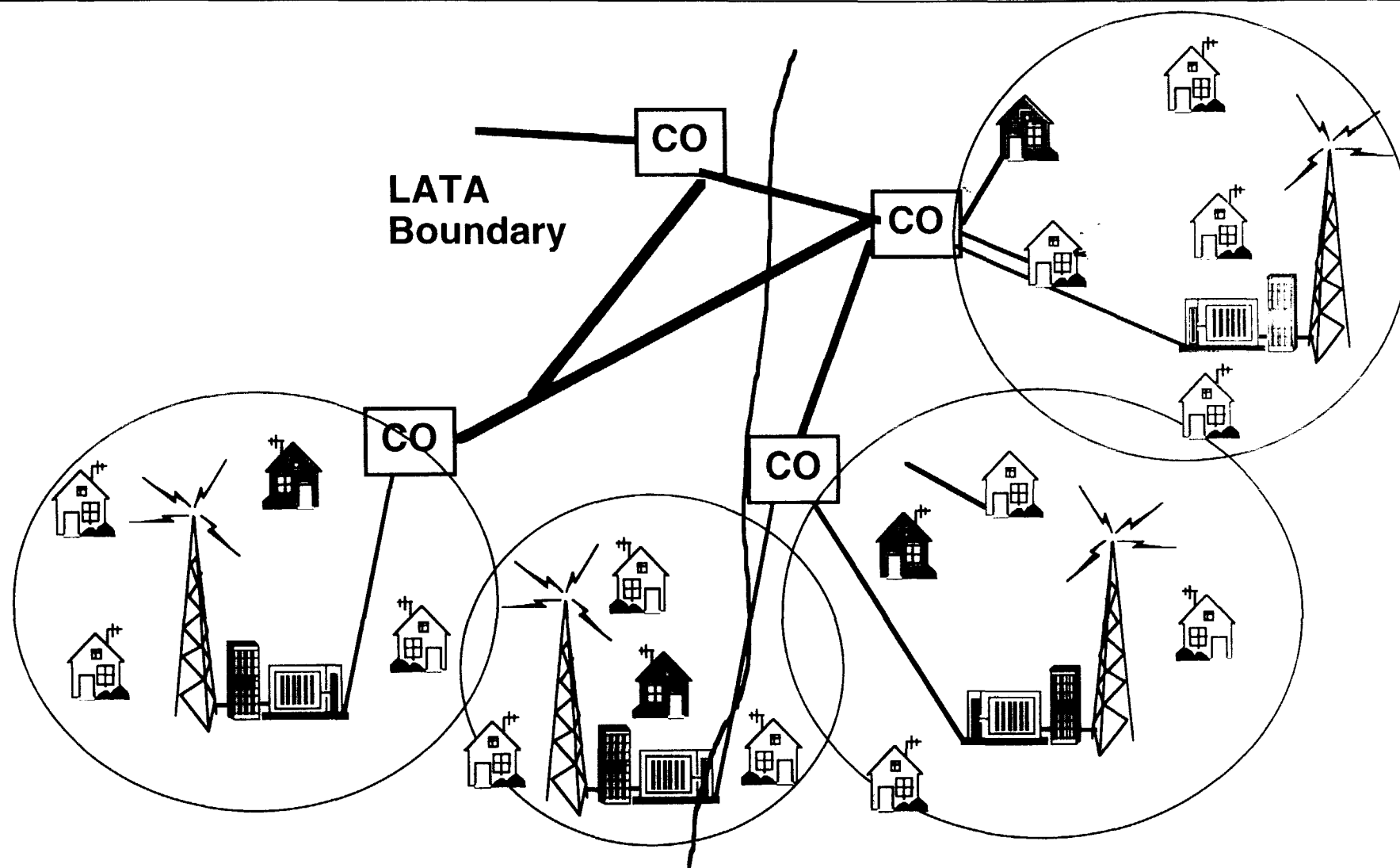
- **Voice codec**
  - ★ trend is from 64kb/s to 32kb/s to 16kb/s to .....
  - ★ moderate increase in voice traffic
  - ★ maintain wireline quality with decreasing spectrum
  - ★ currently delay and/or quality compromise < 16kb/s
- **Data**
  - ★ trend is increasing user bit rates 2400-9600-28800-....
  - ★ trend is increasing volume of data traffic (becoming significant fraction vs. voice traffic)
- **Video**
  - ★ major traffic source especially downstream

# Implementation Issues

- **Impacts of planning or zoning codes**
  - ★ current requirements to pre-install copper drops
  - ★ antenna locations
- **Subscriber density**
  - ★ clustered in tight villages or evenly distributed
- **Competitive/Regulatory environment**
  - ★ multiple wireline operators could trigger a “forest of phone poles”
- **Service Requirements**
  - ★ Wireless prone to propagation artifacts
  - ★ coding or tolerance to delay/throughput helpful



# LATA Issue



**Wireless signals & backhaul both cross LATA boundaries**